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Project Specific Analysis for the Expanded Los Vaqueros Reservoir Project

Introduction

This project has four different facility size alternatives and four operational scenarios with different primary objectives for each scenario[1]. The results here are for the largest reservoir assumed and the largest intake capacity for the project. The reservoir size assumed is 500 TAF and the intake capacity is 500 cfs on Middle River near or on Victoria Canal and 1,250 cfs on Old River at the existing Los Vaqueros Project intake. The results shown are benefits for three of the operational scenarios, which are:

- Operational Scenario #2 – This scenario's primary objective is to develop a water supply for the Environmental Water Account (EWA) or an alternative environmental entity. The second priority is to provide water quality benefits to the South Bay Aqueduct (SBA) State Water Project (SWP) water contractors.

- Operational Scenario #3 - This scenario's primary objective is to develop a supplemental water supply for the South Bay Aqueduct to ensure 100% reliability for those contractors in all years. The second priority is to provide the EWA a water supply and water quality benefits to the SBA water contractors.

- Operational Scenario #4 – Same as Operational Scenario #3 except 10,000 acre-feet is delivered to the Contra Costa Water District (CCWD) for drought reliability purposes in addition to the water delivered to the SBA water contractors for reliability purposes.

Benefits

The following expanded Los Vaqueros Reservoir Project EWA and reliability water supply benefits and SBA water quality benefits were developed using three models as described in the January 2005 "Interim Update of the California Bay-Delta Authority Surface Storage Investigations Interim Common Model Package, Modeling Protocol and Assumptions" report. The three models and how they are used are described below.

1. CALSIM II Common Assumptions baseline model: This model output is used to develop Delta water quality and to characterize the Delta conditions such as availability of Delta surplus flows, the monthly E/I ratio, etc.

[1] There are numerous operational constraints to protect the Delta fishery and other water users including the CVP and SWP. These assumed operational constraints are discussed in a draft December 2003 technical memorandum. A copy of this memorandum can be obtained by calling SWRI at 916-563-6360.

2. Output from the CALSIM II baseline model is input into the 73-year repeating tide version of DSM2.

3. The water quality determined by the DSM2 run and the E/I ratio and Delta surplus flows from the baseline Common Assumptions CALSIM II model are input to Expanded Los Vaqueros Reservoir Project Assessment Model.

This final model determines the amount of pumping that can be done by the expanded Los Vaqueros Reservoir Project. This increase in Delta pumping is input into the CALSIM II Common Assumptions baseline model and the above process is rerun again for two primary purposes which are:

1. To make sure the CALSIM II Common Assumptions baseline model has not increased the water cost of meeting the X2 D-1641 Delta water quality requirement.

2. To determine the effect of expanded Los Vaqueros Reservoir Project pumping on Delta quality and, therefore, the ability of the expanded Los Vaqueros Reservoir Project to pump the quantities pumped in the first model run.

The expanded Los Vaqueros Reservoir Project benefits are shown below.

EWA Water Supply Benefits

(TAF)

Long-term, Drought and Water Year Type Annual Water Year Averages	**Operational Scenario #2**	**Operational Scenario #3**	**Operational Scenario #4**
1922-93	143	123	117
1928-34	52	40	33
1976-77	123	95	80
1986-92	78	49	41
Wet	189	181	178
Above Normal	174	149	141
Below Normal	147	121	114
Dry	126	94	86
Critical	54	43	35

The Project was operated to provide the maximum amount of water to EWA in the wetter water years when EWA needs the most water and needs that water to be produced south of the Delta. That operation strategy results in less water being delivered in dry years. However, the EWA water need is less in dry years and the options for obtaining that

water are greater for EWA than in the wetter years, so the reservoir operation strategy was designed to be consistent with the needs of the EWA.

The average annual, long term EWA water supply benefit for Operational Scenarios #3 and #4 of 120 TAF/yr is calculated as the average of the 1922-93 results for the two multi-purpose scenarios: Operational Scenario #3 (123 TAF/yr) and Operational Scenario #4 (117 TAF/yr). The average annual driest period benefit for Operational Scenarios #3 and #4 of 47 TAF/yr is calculated as the average of the 1928-34, 1976-77, and 1986-92 drought period results for Operational Scenarios #3 and #4. The average annual wet period benefit for Operational Scenarios #3 and #4 of 180 TAF/yr is calculated as the average of the wet period results for Operational Scenario #3 (181 TAF/yr) and Operational Scenario #4 (178 TAF/yr).

Water Reliability Deliveries Benefits to SBA and CCWD

(TAF)

Year Types, Long-term, & Droughts Annual Water Year Averages	**Operational Scenario #3**	**Operational Scenario #4**
1922-93	9	12
1928-34	27	35
1976-77	30	38
1986-92	27	36
Wet	0	0
Above Normal	3	3
Below Normal;	1	1
Dry	9	19
Critical	34	44

The increased deliveries to CCWD in dry and critical years are represented by the difference between Operational Scenario #3 and #4. The SBA contractors and CCWD need water for water supply reliability is in very dry years when water supplies from other sources such as the CVP or SWP are very low. A total additional 189 TAF can be delivered on average under Operational Scenario #3 during the 1928-34 and the 1986-92 droughts. A total additional 249 TAF can be delivered on average under Operational Scenario #4 during the 1928-34 and the 1986-92 droughts.

Water Quality Delivered to SBA Contractors

(Chloride/mg/L)

Year Type & Long-term and Drought Water Year Annual Averages	Operational Scenario #2		Operational Scenario #3	
	Dec—Aug	**Sep-Nov**	**Dec-Aug**	**Sep-Nov**
1922-93 Base	48	107	48	107
1922-93 with Project	43	46	43	51
1929-34 Base	75	120	75	120
1929-34 with Project	62	61	60	81
1987-92 Base	68	127	68	127
1987-92 with Project	51	62	55	78
Wet Year Base	30	79	30	79
Wet Year with Project	36	35	36	36
AN Base	37	106	37	106
AN with Project	40	40	38	41
BN Base	44	114	44	114
BN with Project	42	48	41	50
Dry Base	58	122	58	122
Dry with Project	44	57	46	68
Critical Base	85	128	85	128
Critical with Project	61	54	61	68

The quality delivered by the SWP during the winter and early summer months is usually fair except during critical water years. The expanded Los Vaqueros Reservoir Project allows better quality (28% improvement) water to be delivered in critical years during this period and rather insignificant improvements in other water year types. The SBA contractors' delivered water quality from the SWP becomes much poorer in the late summer and early fall months. The enlarged Los Vaqueros Project improves the delivered water quality dramatically (60% improvement) in all water year types including wet years during this period.

Potential Delta Impacts

To determine the impacts, if any, the changes in Delta water quality, X2 location, Delta outflow, water levels in south Delta, and channel velocity (scour) were calculated using the 16-year astronomical tide version of DSM2. The amount of increased or decreased pumping due to the expanded Los Vaqueros Reservoir Project calculated by the Expanded Los Vaqueros Reservoir Project Assessment Model is input into DSM2 at the location that the changes occurred. In addition, decreased SWP exports by the amount of EWA water developed by the expanded Los Vaqueros Reservoir Project in that year during the February through June period are also input into DSM2; this step effectively increases Delta outflow by the amount of decreased SWP export. Lastly, increased or decreased Delta inflow by the amount of increased or decreased pumping of CCWD CVP contract water during balanced conditions in the Delta (meaning when there is sufficient water flowing from the Delta to the Bay to meet Delta water quality requirements but no unappropriated water is available) are also input into the DSM2 model to get the results shown below.

Delta Outflow
Monthly Mean Outflow
(TAF)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Base	2,177	2,643	2,441	1,612	1,177	724	438	260	247	333	538	1,232
Study #2	2,140	2,638	2,440	1,642	1,205	746	437	260	246	331	537	1,210
Difference	-37	-5	-1	31	28	22	0	0	-1	-2	-1	-23
Study #3	2,140	2,636	2,441	1,638	1,200	742	437	260	246	331	537	1,210
Difference	-37	-8	0	26	23	18	0	0	-1	-2	-1	-23

Delta X2 Position
Monthly Mean Position
(Kilometers)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Base	78.0	72.1	66.6	65.9	68.0	71.0	75.1	79.2	84.3	86.4	85.3	82.5
Study #2	78.1	72.3	66.6	65.8	67.7	70.7	74.6	79.1	84.2	86.4	85.3	82.5
Difference	0.1	0.2	0.0	-0.1	-0.3	-0.3	-0.5	-0.1	-0.1	0.0	0.0	0.0
Study #3	78.1	72.3	66.6	65.8	67.8	70.8	74.7	79.1	84.2	86.4	85.3	82.5
Difference	0.1	0.2	0.0	-0.1	-0.2	-0.2	-0.4	-0.1	-0.1	0.0	0.0	0.0

Banks Pumping Plant
Monthly Mean Water Quality
(Chloride, mg/L)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Base	85	66	46	39	40	44	43	54	86	106	92	86
Study #2	86	66	46	39	40	44	41	54	88	108	93	87
Difference	1	0	0	0	0	0	-2	0	2	2	1	1
Max, Diff.	*3*	*2*	*4*	*11*	*6*	*4*	*2*	*2*	*5*	*4*	*4*	*6*
Study #3	86	66	46	39	40	44	42	55	88	108	93	87
Difference	1	0	0	0	0	0	-1	1	2	2	1	1
Max. Diff.	*3*	*2*	*5*	*8*	*4*	*4*	*2*	*2*	*5*	*4*	*3*	*6*

Tracy Pumping Plant
Monthly Mean Water Quality
(Chloride, mg/L)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Base	86	72	62	47	42	56	59	71	111	109	91	90
Study #2	86	72	62	48	42	56	58	72	112	111	93	91
Difference	0	0	0	1	0	0	-1	1	1	2	2	1
Max. Diff.	*2*	*1*	*4*	*4*	*2*	*1*	*2*	*3*	*4*	*4*	*4*	*5*
Study #3	86	72	62	48	42	56	59	72	112	111	92	91
Difference	0	0	0	1	0	0	0	1	1	2	1	1
Max. Diff.	*2*	*1*	*3*	*3*	*2*	*1*	*2*	*3*	*4*	*4*	*4*	*5*

Chipps Island
Monthly Mean Water Quality
(EC, mmhos/cm)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Base	5.40	3.71	2.20	2.48	3.93	5.45	6.69	8.79	10.68	10.50	8.98	7.84
Study #2	5.43	3.62	2.10	2.37	3.80	5.29	6.61	8.78	10.69	10.52	8.98	7.86
Difference	0.03	-0.09	-0.10	-0.11	-0.13	-0.16	-0.08	-0.01	0.01	0.02	0.00	0.02
Study #3	5.43	3.64	2.13	2.40	3.83	5.33	6.63	8.78	10.69	10.52	8.98	7.86
Difference	0.03	-0.07	-0.07	-0.08	-0.10	-0.12	-0.06	-0.01	0.01	0.02	0.00	0.02

Middle River at Old River
Monthly Minimum Difference in Minimum Stage

(feet)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Base	-0.80	0.00	-0.69	0.00	0.00	0.00	0.00	0.00	0.00	-0.71	-1.44	-1.32
Study #2	-0.85	0.00	-0.73	0.00	0.00	0.00	0.00	0.00	0.00	-0.72	-1.47	-1.34
Difference	-0.05	0.00	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.03	-0.02
Study #3	-0.85	0.00	-0.73	0.00	0.00	0.00	0.00	0.00	0.00	-0.72	-1.47	-1.34
Difference	-0.05	0.00	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.03	-0.02

Old River at Tracy Road
Monthly Minimum Difference in Minimum Stage

(feet)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Base	-1.38	-0.88	-1.33	-1.31	0.00	0.00	-0.17	0.00	0.00	-1.01	-1.48	-1.34
Study #2	-1.46	-0.96	-1.39	-1.38	0.00	0.00	-0.18	0.00	0.00	-1.02	-1.50	-1.37
Difference	-0.08	-0.08	-0.06	-0.07	0.00	0.00	-0.01	0.00	0.00	-0.01	-0.02	-0.03
Study #3	-1.46	-0.96	-1.39	-1.38	0.00	0.00	-0.18	0.00	0.00	-1.02	-1.50	-1.37
Difference	-0.08	-0.08	-0.06	-0.07	0.00	0.00	-0.01	0.00	0.00	-0.01	-0.02	-0.03

Old River Intake (downstream)
Monthly Maximum Velocity Difference

(feet/second)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Base	0.83	0.75	0.88	1.41	1.08	0.96	0.06	0.89	0.78	0.71	1.05	0.92
Study #2	0.86	0.80	0.92	1.45	1.13	1.01	0.21	0.92	0.81	0.73	1.07	0.94
Difference	0.03	0.05	0.04	0.04	0.05	0.05	0.15	0.03	0.03	0.02	0.02	0.02
Study #3	0.86	0.80	1.19	1.45	1.13	1.01	0.92	0.92	0.81	0.73	1.07	0.94
Difference	0.03	0.05	0.03	0.04	0.05	0.05	0.03	0.03	0.03	0.02	0.02	0.02

Middle River Intake (downstream)
Monthly Maximum Velocity Difference
(feet/second)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Base	0.89	0.83	0.82	1.00	0.96	0.83	0.41	0.74	0.69	0.80	0.75	0.84
Study #2	0.89	0.86	0.84	1.02	0.98	0.87	0.44	0.74	0.69	0.79	0.75	0.84
Difference	0.00	0.03	0.02	0.02	0.02	0.04	0.03	0.00	0.00	-0.01	0.00	0.00
Study #3	0.89	0.85	0.83	1.32	0.87	0.91	0.86	0.74	0.69	0.79	0.75	0.84
Difference	0.00	0.02	0.01	0.01	0.02	0.03	0.01	0.00	0.00	-0.01	0.00	0.00

The impact analysis show that the expanded Los Vaqueros Reservoir Project as currently planned has minimal to no impacts on X2 location, Delta outflow, Delta water quality, south Delta water levels, and channel velocities.

Potential CVP/SWP Impacts

The majority of increased pumping of Delta water compared to the base condition by this project would be under a new or modified water right permit that is junior to the CVP and SWP allowing the expanded Los Vaqueros Reservoir Project to pump water from the Delta that is not needed by any current water users including the CVP and SWP or needed to meet Delta water quality requirements (Delta surplus flows). However, a small amount of increased pumping by this project occurs when the Delta is in a balanced condition during the summer and fall months. This water is CCWD CVP contract water.

To ensure that the SWP is not harmed by this project by the increased amount of CCWD CVP contract water pumped in some years, it is assumed in the expanded Los Vaqueros Reservoir Project studies that any increase in pumping of CVP contract water during balanced conditions is pumping of water released from CVP storage. Any additional releases from CVP storage (assumed to be Shasta Reservoir storage) are tracked and if that reduced storage could harm the U.S. Bureau of Reclamation's ability to meet winter-run temperature requirements established by the winter-run Chinook salmon biological opinion or reduce CVP deliveries to water users, the expanded Los Vaqueros Reservoir Project must repay the CVP early in the water year before the impact would occur to ensure no impact to winter-run salmon or the CVP contractors.

The amounts of water delivered to the CVP by year for each operational scenario to ensure no negative impacts to salmon or the water users in each of these studies are shown in the table below.

Water Delivered to the CVP to Ensure No Negative CVP Water Delivery or Salmon Impacts

(TAF)

Year	Operational Scenario #2	Operational Scenario #3	Operational Scenario #4
1924	36.0	36.1	37.2
1929	33.2	32.5	41.2
1931	32.3	32.5	32.0
1933	22.1	23.5	26.8
1934	8.8	9.3	9.9
1935	13.3	13.3	13.3
1977	28.2	27.8	27.8
1988	18.7	28.9	34.1
1990	17.1	17.7	17.5

There would be an impact only in extremely dry water years when relatively small reductions in Shasta Reservoir storage occur due to increased pumping of CCWD CVP contract water by this project. To offset this impact, the above water is delivered to the CVP by the expanded Los Vaqueros Reservoir Project prior to meeting the assumed project objectives such as water supply reliability for the SBA contractors and CCWD or to develop EWA water supply assets. The results included in the EWA Water Supply Benefits and Water Reliability Delivery Benefits to the SBA and CCWD summary tables shown previously have been adjusted to account for these payback quantities so the projected benefits are not overstated.